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A Study of the Effects of County Characteristics on College Enrollment

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Table of Contents

Abstract

For the past 100 years, policy analysts studied college enrollment at the individual level. Yet little research has been performed on whether the surrounding community characteristics contribute to enrollment rates. This is in part due to seeing college attendance as an individual choice whereas K-12 enrollment is typically predetermined by place of residence. However, this ignores the potential impact economic and social characteristics a community has on students while growing up. This paper attempts to add to the literature by testing county level variables with a panel regression with high school fixed effects.

The results show higher averages of KEES (Kentucky Educational Excellence Scholarship) money and eligibility for free or reduced lunch among graduates are the most significant determinants of college enrollment in this study. County variables were mostly insignificant. An exception to this was crime rates for counties with urban clusters, though the coefficient was small. Another was the percentage of college educated adults which was very large, but only when the percentage of graduates enrolled in community colleges was the dependent variable.

My recommendation is twofold. First, policy makers should consider ways to compensate for the effects of student poverty among graduates by exploring the possibility of creating after school tutoring programs. Second, analysts ought to conduct similar studies which compensate for some of the weaknesses of my model by using individual student data, an instrument variable for endogeneity caused by parents, and use variables which measure factors in a smaller community setting.

Introduction

In 2010, approximately 61% of Kentucky's high school graduates attended college after graduation. The rate by high school varied. North Oldham High School had 86% of its graduating seniors enroll in college while Oldham County High School only had 68%. This variation can be explained by the factors within the respective districts. Schools with more graduates attending college may benefit from teaching students whose families are highly educated and have higher incomes. But do the counties where the schools are located affect the number of high school graduates who attend college?

This is an important question because approximately a third of the revenue for elementary and secondary schools is derived at the county-level (US Census, 2015c). Counties also have individuals from different walks of life who may not be actively engaged in the public school system, but may have a profound effect on students as neighbors, community leaders, or employers. This paper attempts to measure the impacts of some of these characteristics over a four-year period, from 2010-2013. Specifically characteristics which have been quantitatively measured by the US Census Bureau and the Kentucky State Police's Annual Crime Reports are the focus of this study. Data controlling for school characteristics are from Kentucky's Center for Education and Workforce Statistics, KCEWS, and the Kentucky Department of Education. The paper is divided into the following sections: literature review, research design, data overview, results, and final discussion.

Literature Review

The literature is limited on describing the effects counties, or communities in general, have on college choice for high school graduates. According to David Chapman (1981) there are two primary reasons for this: 1) colleges tended to place greater priority on targeting desirable

students instead of recruiting those who are available; and, 2) most research considers the decision-making process as influenced by government intervention via loans and grants (p. 491). I would suggest a third reason: the process of choosing to attend college is usually studied through common features among individuals regardless of where they graduated. This is because students are free to choose the school they wish to attend without being limited to a region near their home as they were in high school. Thus, counties and their characteristics are perhaps not expected to significantly impact the college choice process.

This is not to suggest no one has ever considered location as a determinant for college enrollment. Hoxby and Avery (2012), and Hoxby and Turner (2013) found low-income students with strong academic backgrounds were not as probable to receive admissions materials from selective colleges due to their geographic disbursement. And Ghelfi and Parker (2007) studied differences of enrollment between urban and rural students. However, the more popular subjects of college enrollment focus on race, income, and financial aid of individual students. Because the literature for aggregate data by location is sparse, some of the literature in this document includes sources which are focused on individual data studies. This was done under the assumption that what occurs at the individual-level ought to be observable in communities with similar individuals. The review will cover the following: urban vs. rural, financial aid, income, labor markets, and crime.

Urban vs. Rural

Most studies of a student's home environment and college enrollment examine the differences between students from rural or urban areas. The assumption is urban areas will positively influence the percentage of students who attend college due to population size and available resources. Ghelfi and Parker's 2007 survey of American counties appear to support

this reasoning. In metropolitan areas, they found at least 12.4 students per 100 residents enrolled in college (Ghelfi and Parker, 2007, p. 38). Counties containing cities with at least 10,000 residents reported 6.5 to 8.8 students per 100 residents while counties without cities ranged from 0.8 to 3.1 (Ghelfi and Parker, 2007, p. 38). But is this due to the availability of resources?

The answer appears to be yes. Byun, Meece, and Irvin (2012) found students in rural areas are generally poorer and lack resources in their schools to prepare for college or after high school careers (p. 415). The parental expectation to attend college after graduation was also higher among students from urban areas, an average of 0.84, than rural, 0.70 average (Byun, Meece, Irvin, 2012, p. 419). Hoxby and Avery (2012) also found students living in densely populated urban areas have a higher chance to receive more resources available than similar students who live in non-urban areas (p. 29). It can be assumed a similar trend could be found among Kentucky students.

Financial Aid

The subsidization of higher education for the general public in this country began in 1958 with the passage of the National Defense Education Act. The NDEA provided loans to college students as a means of improving America's human capital in the face of the Cold War and the ongoing "space race" (Carleton, 2002; Urban, 2010). It was shortly followed by the Higher Education Act of 1965 which supported and continues to support work studies, need-based student loans, grants, and other federal aid programs (Hansen, 1983; Kramer, 1983). Various states have developed programs for funding higher education. But has government aid encouraged enrollment?

Based on the survey of the literature in Table 1 (see below), the answer is mixed. The determining factor appears to be how financial aid is distributed. At the state level, aid is

typically provided as a grant to colleges which respond by lowering tuition relative to per student expenditures. Since this reduced price occurs for everyone, it is uncertain if these grants encouraged enrollment among those who would have attended without the grants or needy students. Federal aid is usually provided at the individual level, taking into consideration both financial need and college costs. This allows students a greater opportunity to shop and compare schools within and outside of their home state than do state grants.

Table 1

Study	Aid Source	Aid Type	Findings
Dynarski (2003)	Federal	Social Security student benefits	Increased enrollment by 3.6%
St. John and Noell (1989)	Federal	Grants, Loans, Work-Studies, and combinations thereof	All forms of aid are associated with increased enrollment across ethnicities.
Jackson (1978)	Federal	Unspecified	Students who received aid are 7.6% more likely to attend than those who don't.
Hansen (1983)	Federal	Unspecified	No effect on enrollment when controlling for SES and academic ability.
Hearn, Griswold, and Marine (1996)	State	Need-based grants	Unlikely to change enrollment patterns, but may aid low-income students.
Long (2006)	State	Appropriation grants to institutions	Inefficient: lowers sticker price relative to expenditure per student.
Heller (1999)	State	Appropriation grants to institutions	Reduction in appropriation spending would decrease enrollment as sticker price becomes more realistic to costs.

Kentucky has a special student aid program known as the Kentucky Educational Excellence Scholarship, KEES. The program provides Kentucky students a scholarship fund based on high school GPA, ACT score, and AP exam scores with higher grades and scores increasing the scholarship value (Kentucky Higher Education Assistance Authority [KHEAA], 2016). This makes KEES a merit-based program which could favor students from high-income

and well-educated families (Heller, 2006; Farrell 2004). And the KEES scholarship is restricted to in-state colleges, public or private, which can limit recipients' choice of institution.

Income

Closely related to financial aid is the effect of parental income on college enrollment. This is in part due to most types of federal aid targets low-income students who may be more sensitive to budget constraints and rising costs of tuition. Students from higher income families are expected to more easily compensate for changes in tuition without resorting to financial aid. The findings of Edward St. John (1990, p. 173) and Cecilia Rouse (1994, p. 75) agree with this assumption as they found upper-income students are on average less sensitive to changes in tuition and financial aid.

But higher family income does not necessarily mean students will have a greater propensity to enroll. Irenee Beattie (2002) found students from high socio-economic status (SES) families are 6% more likely to enroll in states with low college costs than those with high costs, suggesting high-income students are sensitive to tuition costs (p. 30-31). Yet a similar pattern also occurs, albeit to a lesser extent, among average and low SES students. This suggests the average student tends to act rationally by choosing colleges with lower admissions costs.

Choice in school type also appears to be affected by income-level. McPherson and Schapiro (1998) found about 47% of lower income students in 1994 attended public, two-year schools, a 1.4% increase from 1980 (p. 44). In contrast, 8.6% of students with family incomes of more than $100,000 attended public, two-year schools, nearly a 6% drop from 1980 (McPherson & Schapiro, 1998, p. 44). However, two-year colleges sometimes serve as placeholders for students who are trying to prepare for college standards. This may help to minimize time and money spent at traditional four-year schools by avoiding remedial courses. Thus, enrollment in

these junior colleges could be more of a reflection of students' academic aptitude than their financial situation.

Labor Markets

Employment opportunities could also affect students' college going-decisions. Assuming students are behaving rationally, they may choose to forgo the potential benefit of a high paying job after college if they feel the job market currently has a high demand for workers. But what if demand is low? Current literature appears divided on this point. Some researchers found weak or no relationships between labor market conditions and college enrollment (Manski and Wise, 1983; Grubb, 1988). Others such as Julian Betts and Laurel MacFarland (1995) found community college attendance is positively correlated to the rise and fall of unemployment (p. 749). And Beattie (2002) argues the answer depends on SES and race of the students (p. 35).

Crime

There appears to be a consensus within the literature as the level of education increases within a community, crime on average is reduced (Machin, Marie, & Vujic, 2011; Lochner, 2004; Ehrlich, 1975). But does criminal behavior reduce educational opportunities? The answer is yes. Kirk and Sampson (2013) affirm criminal or deviant behavior among Chicago students and minorities in particular lead to a decrease in educational attainment beyond high school (p. 55-56). And Randi Hjalmarrson's study in 2007 found "a strong negative correlation between high school graduation and arrest and incarceration" (2008, p. 628). Both agree that an increase of human capital through education gives students skills necessary to obtain better benefits through legal means instead of illicit ones. However, these studies observed how the criminal behavior of individual students affected themselves but not the impact of the behavior of their peers or neighbors.

Literature Overview

The above is a brief summary of what past research has concluded on some of the variables used in for the model. A common theme in each section is the availability of financial resources to students. Urban students tend to benefit from revenue derived from a larger and presumably higher tax base than their rural counterparts. Financial aid tends to have a significant impact on poorer students depending upon the means of distribution. Students from higher income families are somewhat less sensitive to the costs of college. Labor markets may at best have a weakly positive relationship among high school graduates who choose to attend college. And crime has a negative effect on education and income for students with a criminal history.

Based on this information, I hypothesize high schools located in counties with access to resources such as high-incomes, urban areas, and better-educated neighbors will experience a larger percentage of graduates attend college. On the other hand, high schools in counties with low resources and have high crime or low unemployment rates will be associated with a smaller percentage of graduates attending college.

Research Design

I am testing to determine whether some county variables affect the college enrollment rate of public high school graduates through a regression with high school fixed effects. The data used is a panel where each observation is a Kentucky high school in a year. The years observed are 2010-2013. The following will serve as the framework for my model:

$$Y_{it}=\beta_1 X_{1,it}+\ldots\beta_k X_{k,it}+\alpha_i+u_{it}$$

where Y is the enrollment rate for i high school for t year; X_{it} is the independent county variable for a given school and year (see Table); α_i is the high school fixed effect; and u_{it} is the error term.

As stated in the literature overview above, I expect variables measuring the level of available resources to students such as high-incomes or large, college educated population to be positively significant. Variables which decrease resources such as crime or offer potentially better alternatives such as high employment rates will be significantly negative.

Dependent Variables

The dependent variable is the college attending rates, in percentages, of each of the public high schools in Kentucky from academic years 2010-2013 rounded to the nearest 1%. These rates are from the Kentucky Center for Education and Workforce Statistics, a state organization mandated to collect Kentucky school data for the purpose of assessing educational policy and school performance (Kentucky Center for Education and Workforce statistics [KCEWS], 2016a). I chose not to use private high schools because public rates were more readily available and provide a wider range of students.

Independent Variables

The independent variables are listed in Table 2 below. Though some aspects of each high school observed are controlled by the high school fixed effects variable α_i, it is possible to control for the graduating class' ACT composite scores, average KEES money awarded, and percentage of graduates eligible for free or reduced lunch (see Table 2 below). ACT composite scores capture the class's academic ability without regard to grade inflation. KEES awards control for financial aid. Though the KEES program is not the only student aid program available, its intent is to make in-state institutions more affordable for students might encourage those who are poor yet high achieving to apply. And eligibility for free or reduced lunch controls for the effects that poverty and low-incomes have on students.

County variables were divided into two groups: economic and social. The economic variables are estimates from the State and County Quickfacts from the US Census Bureau (US Census Bureau [USCB], 2015a). The first is a county's unemployment rate. As mentioned in the literature review, high unemployment is considered to be a weak incentive for students considering college. Family median income measures financial resources available within a county. The Census Bureau offers both household and family income. The Bureau defines households as "all people who occupy a housing unit regardless of relationship" (USCB, 2011). The definition for families is similar where two or more of the members are related by blood or marriage with one of them as the "householder" (USCB, 2011). Family median income was chosen because most students are likely to live with family members and median income will not be biased by outlier salaries. Incomes are scaled by $100.

Table 2: Independent Variables

Variable	**Measure** (%s rounded to nearest 1%)	Source
Reduced Lunch	% of graduates eligible for free or reduced lunch	KCEWS (2016b)
ACT scores	Senior class ACT composite score	KDE (2016)
KEES	Avg. KEES money earned by graduates, scaled by $100	KCEWS (2016b)
College Educated Adults	% of adults, 25 and older, with a bachelor's degree or higher	US Census (2015a)
Crime Rate	number of offenses in county per 1000 people	KSP (2016)
Unemployment	% of a county's labor force unemployed	US Census (2015a)
Median Income	Family median income rounded and scaled to the nearest $100.	US Census (2015a)

There are two social variables. First is the level of adult education within a county. If students have more community members, neighbors or employers, with college degrees, students may feel socially pressured to pursue a college degree as well. The final independent variable is crime. As noted in Table 2, this variable measures offenses reported per-1,000 people. The offenses included are murder, rape, robbery, assault, burglary, larceny, auto-theft, and arson because these were consistently reported by county from 2010-2013.

Data Overview

In this section I briefly discuss the descriptive statistics of the data and the implications they might have for the results of the model. I observed 178 high schools from 2010-2013. Table 3.1, see below, displays the observations, means, and standard deviations for each variable. Noticeably free and reduced lunch, KEES, and crime variables have less than 710 observations due to redactions and omissions in the data sources. For the reduced lunch and KEES variables, KCEWS does not report student data if the category measured has less than ten students (KCEWS, 2012, p. 5). For crime, the Kentucky State Police Report for 2012 omitted the offense data for Floyd and Webster Counties (KSP, 2013). The assumption is these omissions will not negatively affect the model since only 6% or less of observations are missing.

Table 3.1: Descriptive Statistics

Variable	Obs.	Avg.	Std. Dev.
Enrolled Graduates	710	0.604	0.011
Reduced Lunch	710	0.494	0.180
ACT scores	710	18.739	1.568
KEES	667	10.605	2.278
College Educated Adults	710	0.175	0.089
Crime Rate	705	24.074	16.359
Unemployment	710	0.097	0.027
Median Income	710	50.684	12.519

Another point to consider is the correlation among the independent variables (see Table 3.2). Particularly strong correlations include KEES and ACT scores, free and reduced lunch with ACT scores, and adult education and median income. This could mean the model suffers from multicollinearity which is tested in the results section.

Table 3.2: Independent Variable Correlations

	Reduced Lunch	ACT Scores	KEES	College Educated	Crime Rates	Unemployment	Median Income
Reduced Lunch	1						
ACT scores	-0.78	1					
KEES	-0.52	0.71	1				
College Educated Adults	-0.47	0.44	0.19	1			
Crime Rate	-0.31	0.27	0.12	0.36	1		
Unemployment	0.51	-0.35	-0.16	-0.40	-0.18	1	
Median Income	-0.68	0.52	0.27	0.82	0.27	-0.53	1

Results

Overall Enrollment

For the first regression a Hausman test is performed to affirm high school fixed effects, or FE, model is the correct model specification. The resulting p-value was <0.001 which means the u_i errors are correlated with the indicator variables and fixed effects is preferred to random effects. The initial FE model (see Table 4.3 below) has an F-test of 7.83 and a p-value <0.001 suggesting my model does have explanatory power. However, there is potential for heteroskedacity within model. Using the robust option in STATA, the F-test decreases to 3.88 and has a p-value 0.0006. This option will be used for the rest of the models.

As mentioned in the Data Overview section, there is potential for multicollinearity between ACT scores, KEES, and reduced lunch. To test this each variable will be removed from

the model to test the effect its absence has on the p-values of the other variables. Table 4.1 shows the results.

Table 4.1: Multicollinearity Test Among School Independent Variables
(Robust-Std. Err.)

	ACT Scores	Reduced Lunch	KEES	F-test	rho
All Three Variables Included	0.008 (0.005)	-.155** (0.046)	0.010*** (0.002)	5.39***	0.728
ACT Omitted	-	-0.159** (0.045)	0.010*** (0.002)	5.97***	0.750
Reduced Lunch Omitted	0.010* (0.005)	-	0.010*** (0.002)	4.30**	0.813
KEES Omitted	0.011* (0.005)	-0.168*** (0.047)	-	3.18**	0.733
KEES, Reduced Lunch Omitted	0.011* (0.005)	-	-	1.49	0.817
KEES, ACT Omitted	-	-0.172*** (0.046)	-	3.14**	0.767
Reduced Lunch, ACT Omitted	-	-	0.011*** (0.002)	4.54***	0.834
Legend:	*p<0.05; **p<0.01; ***p<0.001				

Reduced and free lunch coefficient increases in size and significance when one or both of the other school variables are dropped from the equation. ACT scores change in size only slightly and never increase in significance beyond the 95% confidence level. KEES also barely changed in size and did not experience an increase or decrease of statistical significance. Interestingly, the F-test decreased in significance when reduced lunch, KEES, or both were removed from the regression. And the intraclass correlation, rho, greatly increased in the absence of reduced lunches. This suggests reduced lunch makes up approximately 3-4% of the variance between high schools.

These results show only ACT scores improve in the absence of the other school level variables and its presence only helps to reduce intraclass correlation by about 2%. Since KEES

awards are determined from a combination of GPA, ACT, and Advanced Placement scores, it probably serve as a better control for academic ability than ACT scores. Therefore, the ACT is probably a redundant variable and will be removed from the model.

Adult education and median income were also highly correlated with each other. Table 4.2 displays the regression results if either are dropped. Based on the results, it does not appear either variable increases in significance with the absence of the other or decreases the significance of the model. And rho only changes from 0.2%-0.6%. Therefore both will be kept.

Table 4.2: Multicollinearity Test Among County Independent Variables
(Robust-Std. Err.)

	Median Income	College Educated Adults	F-test	rho
Both Variables Included	-3.54E-04 (0.001)	-0.055 (0.245)	5.97***	0.750
Median Income Omitted	-	-0.070 (0.228)	7.16***	0.748
College Educated Adults Omitted	-4.69E-04 (0.001)	-	7.20***	0.742
Legend:	*p<0.05; **p<0.01; ***p<0.001			

There is also the possibility the dummies for the years observed have coefficients jointly equal to 0. After running a hypothesis test, the results were an F-test of 2.67 and a p-value of 0.049. This means the coefficients are not equal to 0 and the years 2011, 2012, and 2013 need to be included in the model (see Table 4.3 below).

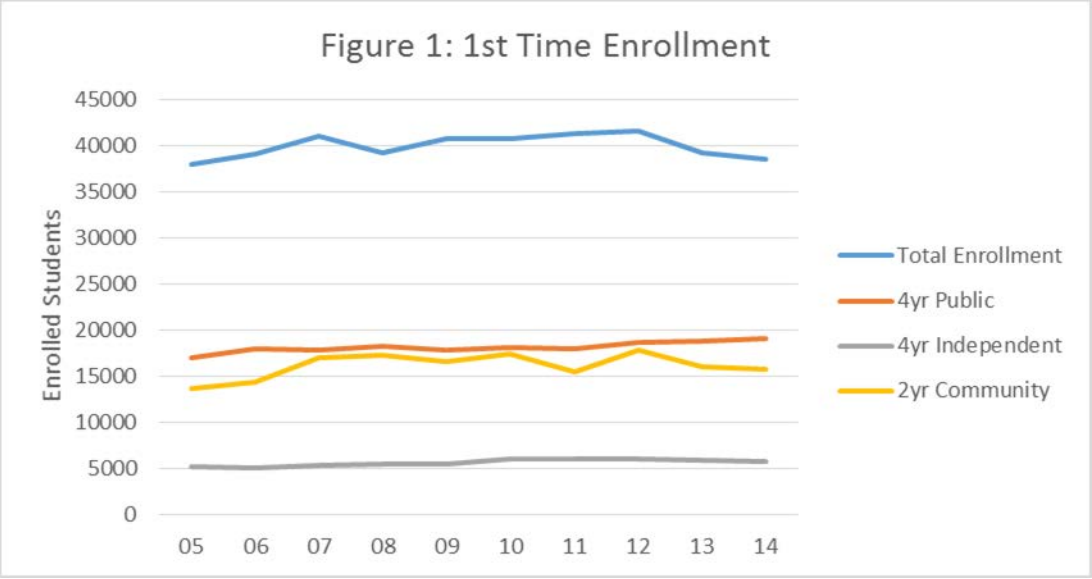
Table 4.3: Overall Enrollment, FE Results (Std. Err.)			
	1st Model (n=178)	**Robust, ACT Omitted** (n=178)	**Robust, ACT Omitted, Time-Fixed** (n=178)
Reduced Lunch	-0.155*** (0.035)	-0.159** (0.045)	-0.111* (0.044)
ACT scores	0.008* (0.004)	-	-
KEES	0.010*** (0.002)	0.010*** (0.002)	0.012*** (0.003)
College Educated Adults	-0.040 (0.183)	-0.055 (0.245)	0.041 (.280)
Crime Rate	4.26E-04* (1.71E-04)	4.34E-04 (2.56E-04)	4.46E-04 (2.53E-04)
Unemployment	-0.113 (0.166)	-0.131 (0.179)	0.130 (0.204)
Median Income	-0.001 (0.001)	-3.54E-04 (0.001)	0.002 (0.001)
2011	-	-	-0.010 (0.006)
2012	-	-	-0.017** (0.006)
2013	-	-	-0.026** (0.008)
F-test	9.33***	5.97***	4.80***
Rho	0.728	0.750	0.739
Legend:	*p<0.05; **p<0.01; ***p<0.001		

Of the high school variables KEES had the greatest level of significance, yet its positive coefficient is small with an enrollment increase of 1.2% for every $100. One explanation is KEES awards are determined on the basis of academic ability of students and admissions offices do aggressively target high achieving students to recruit. Thus it can serve as an accurate proxy for academic ability of graduates. On the other hand, KEES money is mostly for students who attend in-state schools and has a limited award amount. Students with high enough GPAs and

test scores can be offered larger financial aid packages from both in and out-of-state institutions thus reducing the importance KEES money plays in choosing to attend college.

Eligibility for reduced or free lunch was also statistically significant, but had a larger and negative coefficient than KEES. Because this lunch program is offered only to students from very low-income families, schools with a higher number of poor students are least likely to have the resources to attend college. Table 3.2 also shows reduced lunch had strong, negative correlations with ACT scores, KEES, and adults with a bachelor's degree or higher. This is probably because poorer students on average have a lower academic proficiency and fewer chances to be exposed to college educated neighbors.

Crime rates was the only county variable that was statistically significant, but only for the first model. Once heteroskedacity was controlled for, its significance diminished. The years observed were also significant with negative coefficients increasing in size. This reflects the overall trend for first college enrollment as depicted in Figure 1 below. While four year public and independent schools show slight increases, Kentucky's community colleges have been experiencing a decrease in enrollment.



Source: Council for Postsecondary Education, 2015

To determine the cause for the decline in community college enrollment, I ran a regression with community college enrollment among high school graduates as the dependent variable (see Table 4.4). KEES was significant and negative. This makes sense because community colleges tend to serve as a preparation stage for students who are not ready for college level work. And highly academic students also are more likely to be offered aid packages to schools where their abilities can be challenged. So perhaps schools with strong academic students see fewer graduates enrolling in community colleges. Unemployment was negatively significant. Perhaps students who attend community college work part-time jobs to support their educational finances. High unemployment then would discourage these types of workers.

The number of adults with a bachelor's degree or higher is also significant and has a large and positive coefficient. Without individual student data, it is not possible to know for certain what the interaction is between students and their college educated neighbors. However, it could be having a highly educated populace creates a social expectation to participate in postsecondary education not matter the type of institution attended.

Table 4.4: Community College Enrollment per High School, FE Results (Robust-Std. Err.; n=178)	
Reduced Lunch	0.321 (0.071)
KEES	-0.011* (0.005)
College Educated Adults	0.682* (0.343)
Crime Rate	2.91E-04 (2.24E-04)
Unemployment	-0.490 (0.322)
Median Income	-0.002 (0.003)
2011	-0.038*** (0.010)
2012	-0.028* (0.012)
2013	-0.023 (0.013)
F-test	5.49***
rho	0.880
Legend:	*p<0.05; **p<0.01; ***p<0.001

Appalachian and Urban Status

Because high school fixed effect models absorb time invariant variables such as a county's location, it is not possible to test the significance of a county's urban or Appalachian status on college enrollment. However, it is possible to run regressions using data from schools located in certain counties. Table 4.6 below displays the results of regressions which are primarily rural, contain urban clusters or urbanized areas, Appalachian, and non-Appalachian. Time-fixed effects were only need for counties with urban clusters and non-Appalachian counties.

Urban status is determined by the US Census Bureau based on “densely developed territory, and encompass residential, commercial, and other non-residential urban land uses” (2015b). The Census Bureau has two urban area types: 1) urbanized areas which have a population of 50,000 or more, and 2) urban clusters which have a population of 2,500-49,999 (US Census 2015b). Appalachian counties are determined by the Appalachian Regional Commission or ARC (“Counties in Appalachia”). The ARC defines Appalachia as “a 205,000-square-mile region that follows the spine of the Appalachian Mountains” and is mostly rural and historically poor (“The Appalachian Region”). Table 4.5 above displays the summary statistics for each of these categories.

Table 4.5: County Constants

Rural				Urban Cluster			
Variable	**Obs**	**Mean**	**Std. Dev.**	**Variable**	**Obs**	**Mean**	**Std. Dev.**
Enrolled Graduates	264	0.590947	0.09162	**Enrolled Graduates**	316	0.595823	0.084588
KEES	251	1080.299	195.5622	**KEES**	286	1058.378	172.4234
Reduced Lunch	255	0.49698	0.188111	**Reduced Lunch**	280	0.508786	0.15766
College Educated	264	0.14428	0.081797	**College Educated**	316	0.151582	0.060674
Crime Rates	263	17.53232	11.249	**Crime Rates**	312	28.09936	15.94342
Unemployment Rates	264	0.095758	0.030111	**Unemployment Rates**	316	0.101772	0.027821
Median Income	264	50304.17	15587.73	**Median Income**	316	46691.39	9174.845
Urbanized Area				**Appalachian**			
Variable	**Obs**	**Mean**	**Std. Dev.**	**Variable**	**Obs**	**Mean**	**Std. Dev.**
Enrolled Graduates	130	0.650692	0.156736	**Enrolled Graduates**	276	0.578297	0.086514
KEES	130	1021.47	365.5407	**KEES**	253	1034.427	160.8916
Reduced Lunch	130	0.454692	0.204159	**Reduced Lunch**	254	0.624095	0.132124
College Educated	130	0.293154	0.056555	**College Educated**	276	0.118297	0.045074
Crime Rates	130	27.64615	21.24456	**Crime Rates**	272	19.27206	14.93774
Unemployment Rates	130	0.089846	0.012007	**Unemployment Rates**	276	0.108623	0.03222
Median Income	130	61158.46	3241.92	**Median Income**	276	39968.84	7019.312

non-Appalachian			
Variable	**Obs**	**Mean**	**Std. Dev.**
Enrolled Graduates	434	0.620438	0.113949
KEES	414	1074.715	264.025
Reduced Lunch	411	0.41309	0.157404
College Educated	434	0.210714	0.090794
Crime Rates	433	27.09007	16.5074
Unemployment Rates	434	0.090184	0.019941
Median Income	434	57497.65	10276.33

Table 4.6: Models Explaining % Bound for College, by County Status, FE (Robust Std. Err.)					
	Rural (n=66)	**Urban Cluster** (n=79)	**Urbanized Area** (n=33)	**Appalachian** (n=69)	**non-Appalachian** (n=109)
Reduced Lunch	-0.153 (0.084)	-0.063 (0.051)	-0.422*** (0.076)	-0.095 (0.068)	-0.147** (0.055)
KEES	0.015*** (0.004)	0.007* (0.003)	0.010 (0.005)	0.013** (0.005)	0.011*** (0.003)
College Educated Adults	-0.242 (0.362)	0.410 (0.254)	-0.930 (0.659)	-0.052 (0.314)	0.115 (0.295)
Crime Rate	-3.22E-04 (0.001)	0.001* (4.09E-04)	0.001 (2.98E-04)	0.001 (2.56E-04)	1.19E-04 (2.48E-04)
Unemployment	-0.300 (0.248)	0.628 (0.382)	0.382 (0.951)	-0.062 (0.194)	0.142 (0.306)
Median Income	-0.001 (0.002)	0.003 (0.002)	0.007 (0.006)	2.69E-04 (0.002)	0.003 (0.001)
2011	-	-0.027** (0.010)	-	-	-0.026*** (0.007)
2012	-	-0.033** (0.010)	-	-	-0.026** (0.008)
2013	-	-0.037* (0.014)	-	-	-0.040*** (0.009)
F-test	4.34**	2.42*	8.74***	3.40**	6.19***
rho	0.753	0.750	0.820	0.638	0.797
Legend:	*p<0.05; **p<0.01; ***p<0.001				

KEES was significant across most of the model except for counties with urbanized areas. In that model only reduced lunch was significant. This means poverty for counties with urbanized areas is a hindrance for students both academically and attending college. Reduced lunch was also significant for non-Appalachian county high schools. This is understandable since Appalachian counties do not have urbanized areas. Crime rates were also significant and positive in counties with urban clusters, but they had a small magnitude. This could mean students desire to better their situation by leaving and attending school. But given that the

coefficient is small, this may not be a major factor for college-going students overall. The variables for years were significant in both of the models they were used.

Interestingly, rho was small at 64% relative to the other models when only schools in Appalachian counties were observed. This could mean location of a school's county within the state largely contributes to the variance between schools. However, the model with non-Appalachian county schools had a rho of nearly 80%. This may be due to fact the regions these counties are located in are not very homogenous despite their non-Appalachian status. Future studies of this subject may want to consider other means of designating regions for counties to see if this reduces the unobserved variance between schools.

Final Discussion

Policy Recommendations

This study was designed to see if certain county characteristics significantly affected the percentage of college-going students in Kentucky high schools. My hypothesis was schools located in counties with access to resources such as high incomes, urban areas, and a large, college educated population would experience a larger percentage of graduates attending college. Schools in counties with lower incomes and had high crime or employment rates would see fewer graduates going to college. Based on the results above, only crime rates were significant. Yet this was only for the first model when ACT scores were included and when counties with an urban cluster were included. And the number of college educated adults was also significant, but only relative to community college enrollment. Therefore, my hypothesis is currently rejected and no policy recommendations based on county characteristics can be made at this time.

But the results describing the graduates suggest law makers do have opportunities to encourage more high school graduates to go to college. When looking at the overall college

enrollment, a percent increase of students eligible for reduced lunch decreases the number of college-going students by 11%. This suggests poverty has a negative peer effect among high school graduates. The state government ought to consider what programs can be implemented to neutralize the effect of poverty on students.

This could be accomplished by funding after school tutoring programs to elevate students' academic ability. The revenue for this can be obtained by cancelling the KEES program. As seen in Table 4.3 above, KEES money is highly significant due to its basis on academic ability. But, as mentioned in the literature review, students who benefit from merit-based scholarships on average come from high-income families who do not have to rely on these scholarships to attend college. Also, those with competitively high GPAs and test scores are likely to receive larger institutional aid packages than can be offered by KEES.

Future studies, however, will need to consider the impact and negative consequences this type of program could have. For example, will poor students see additional instruction as the opportunity cost of having an after school job? Does KEES money encourage students to attend college in-state? Will students who are academically challenged favor other means of obtaining financial aid such as music or athletic scholarships and not attend the after school programs? These questions are outside the scope of this paper; however, the answers may prove beneficial to increasing the number of graduates who attend college.

Limitations

There were limitations to the models used which affect the interpretation of their results. First, the models only used aggregate data at both the high school and county levels. This means inferences can only be made about students as a group and not as individuals. Second, the dependent variable only includes students who applied for college and were accepted. It does

not include the possibility for students who applied but were not accepted or failed to apply at all. This is connected to using aggregate instead of individual data. Researchers in future studies of this topic may find using individual data will provide a better picture for why some students attend college and others do not.

Third, though not apparent from the results, there is also the issue of endogeneity. It is already known that parents will attempt to move to higher income neighborhoods so their children can benefit from attending the local schools. If parents know school districts in another county have high college enrollment rates among high school graduates, they might move there to benefit their children. An instrumental variable would be needed then for future studies on this subject.

And finally, the variance between schools was very large across all models ranging from about 64-83%. Because the focus of the study is on the effects of county characteristics, some of the high school related factors which make up this variance may be unimportant. But it could also mean counties are too large of an area to measure the effects of community variables such as income or education. I used counties because they have well defined borders, which school districts do not always have, up to a third of school revenue are from local taxes, and 99 of Kentucky's 120 counties have one public high school. Plus, counties already serve as the basis for many Kentucky communities with residents participating in county fairs, Christmas parades, and homecoming games for football. But a future study which limited non-school variables to individuals or groups within a school district might see those variables to be more statistically significant than at the county level.

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